

Informatics Competencies Pre- and Post-Implementation of a Palm-based Student Clinical Log and Informatics for Evidence-based Practice Curriculum

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ABSTRACT

The purpose of this paper is to describe the implementation and evaluation of a two-part approach to achieving informatics competencies: 1) Palm-based student clinical log for documentation of patient encounters; and 2) informatics for evidence-based practice curriculum. Using a repeated-measures, non-equivalent control group design, self-reported informatics competencies were rated using a survey instrument based upon published informatics competencies for beginning nurses. For the class of 2002, scores increased significantly in all competencies from admission to graduation. Using a minimum score of 3 on a scale of 1=not competent and 5=expert to indicate competence, the only area in which it was not achieved was Computer Skills: Education. For 2001 graduates, Computer Skills: Decision Support was also below 3. There were no significant differences in competency scores between 2001 and 2002 graduates. Computer Skills: Decision Support neared significance. Subsequently, the approaches were refined for implementation in the class of 2003.

INTRODUCTION

Within the context of improving patient safety and enabling evidence-based nursing practice, the Columbia School of Nursing has initiated curricular changes to enhance the informatics competencies of its students and graduates. A number of activities have been undertaken across the Entry-to-Practice (ETP) and Master's advanced practice nurse curricula.^{1,2} The purpose of this paper is to describe the implementation and evaluation of a two-part approach to achieving informatics competencies: 1) Palm-based ETP student clinical log for documentation of patient encounters; and 2) informatics for evidence-based practice (EBP) curriculum.

BACKGROUND

Informatics Competencies

Professional clinical societies, educational accreditation organizations, and informatics associations have initiated activities and in some

instances, guidelines or criteria for informatics competencies for clinicians, informatics specialists, and informatics innovators.³⁻⁷ Moreover, reports such as that of the Pew Health Professions Commission have identified effective and appropriate use of information and communication technologies as an essential competency for all health care professionals.⁸

Beyond its explicit role in improving patient safety and enabling evidence-based practice,⁹ some have argued that information technology is a critical component to managing the severe nursing shortage.¹⁰ Consequently, although research related to informatics competencies in nursing has been conducted for more than a decade,¹¹⁻¹⁴ there is now heightened interest in ensuring that graduates of nursing programs have sufficient informatics competencies to meet the demands of the variety of health care settings in which they will assume positions.

Most recently, Staggers et al published a set of informatics competencies for nurses at four levels of practice: beginning nurse, experienced nurse, informatics specialist, and informatics innovator.¹⁴ Investigators developed and initially validated the competencies through literature review and expert consensus. Building upon this work and others, the American Nurses Association (ANA) published the Scope and Standards of Nursing Informatics Practice.³ The document not only delineates informatics nurse specialist practice, but also describes informatics competencies for beginning and experienced nurses. The beginning nurse competencies focus on fundamental information management and computer literacy skills and the use of existing informatics solutions and available information to manage their practice.

The competencies for beginning nurses as published by Staggers et al. served as the basis for the informatics competency evaluation in this study.¹⁴

Entry-to-Practice Program

The ETP Program at Columbia University School of Nursing is designed to prepare students

with bachelor's degrees in other fields for the first step in a career as an advanced practice nurse. Phase I (ETP-BS) prepares the student for basic practice as a registered nurse (RN) and Phase II (MS) focuses on preparation for an advanced practice role (nurse practitioner, nurse anesthetist, nurse midwife). Phase I, which is the focus of the activities described in this paper, includes instruction in the biological and behavioral sciences and incorporates clinical and didactic learning in nursing science necessary for the first professional degree. Clinical education receives major emphasis, with patient experiences beginning early in the first term. Theory and clinical practice are related to the promotion of health and prevention of illness, as well as to the care of the sick and their restoration to optimal health. Students work with patients in a variety of settings, such as clinics, hospitals, community centers, and home. The curriculum is built on the integrated health model. The initial focus is on promotion of health and prevention of illness.

Student Clinical Log

The ETP student clinical log was designed to support student documentation of patient encounters and benchmarking of practice over time and to provide an educational record of their experiences. It served as a primary tool in assisting students to understand "what nurses do" and to recognize their role in building evidence from their practice. The student clinical log was completed in addition to the clinical documentation required in each clinical setting.

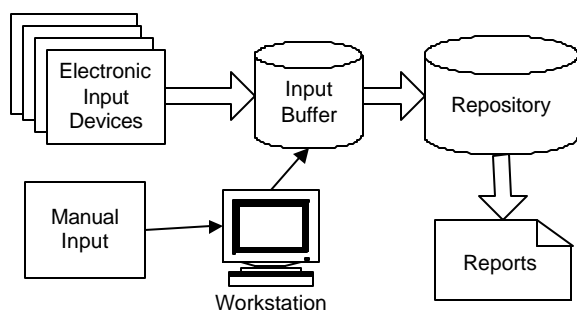


Figure 1. System architecture

The overall system consists of a set of clinical data input capabilities, an intermediate store for buffering, verifying, and scrubbing the input data, and a repository for storing the collected data and housing the knowledge base (Figure 1).¹⁵ Students enter clinical data into Palm M500-M515s. Data transfer from the Palm devices is managed through a synchronization process using XTNDConnect Server™ software over both wired and wireless network connections to the Input Buffer, which is implemented as a set of tables in Microsoft Access running on a Windows XP Server.

Data scrubbing and transformation is accomplished through a set of manual procedures and SQL queries that move the scrubbed data into the repository. A number of reports based on queries against the repository have been developed to permit faculty and students to interpret the collected data.

The Palm-based clinical log application was developed using the Satellite Forms Palm OS development tool suite. Students entered a subset of de-identified data (i.e., no patient names, medical record numbers, or other identifiers were used, simply a two or three letter "code" of the students' choosing) from patient encounters (Figure 2).

The screenshot shows a 'Patient' screen with a title bar 'UNI: ZZ9998'. It contains the following fields: 'Patient ID:' followed by a text input field, 'Age: Years' with a dropdown arrow, 'Gender: ' with a dropdown arrow, and 'Race: ' with a dropdown arrow. At the bottom, there are three buttons: 'Add Encounter', 'Cancel', and 'Back'.

Figure 2. Patient Demographic Screen

Where possible, standardized terminologies were used to represent the data elements; in other instances, custom terminologies were developed. The primary standardized terminology implemented was the Home Health Care Classification¹⁶ that was used for nursing diagnoses, nursing interventions, and expected outcomes. In order to improve ease of data entry, nursing interventions were pre-specified in the knowledge base for each nursing diagnosis (Figure 3).

The screenshot shows an 'Intervention' screen with a title bar 'UNI: ZZ9998'. It contains the following fields: 'Nursing Diagnosis: Respiration Alt', 'Please Select from List:', and a list box containing the following items: 'Breathing Exercises-C', 'Breathing Exercises-T', 'Chest Physiotherapy-C', 'Inhalation Therapy-C', 'Oxygen Therapy Care-A', 'Oxygen Therapy Care-C', and 'Respiratory Care-A'. At the bottom, there are two buttons: 'Cancel' and 'Encounter'.

Figure 2. Nursing Intervention Screen

Students in the class of 2002 (intervention group) received multiple iterations of the clinical log application as it was revised over the Spring semester. Each student was sent a clinical data summary approximately every two weeks for the semester of use. The reports included counts of unique Primary Medical Problems, Nursing Diagnoses, Nursing Interventions, and Intervention Performance Contexts. Usage data and lessons learned will be reported elsewhere. Class of 2001 (comparison group) did not use an electronic clinical log as part of their educational program.

Informatics for Evidence-based Practice Curriculum

A 3-credit semester-long course on informatics for EBP was required for all 2002 ETP students. Additional EBP principles and information retrieval strategies were addressed in the introductory research course. Prior to this time (class of 2001), 9 hours of informatics content was offered as part of a combined management and informatics course.

At the conclusion of the informatics for EBP course, learners were expected to be able to:

- Compare the strengths and weaknesses of various standardized terminologies for the representation of data elements related to nursing practice
- Use informatics tools to retrieve and critically analyze data, information and knowledge
- Analyze a case study using a web-based diagnostic decision support tool
- Perform a decision analysis using software that supports expected value decision making methods
- Synthesize evidence on a selected topic of relevance to advance practice nursing and assess its readiness for application to practice.

Course methods included lecture, demonstration, and computer laboratory for selected topics. Computer literacy was assumed as a prerequisite for the course.

METHODS

Research Questions

A repeated-measures, non-equivalent control group design (Figure 4) was used to address two research questions:

- Were there differences in self-reported nursing informatics competencies before and after implementation of a Palm-based student log and informatics for EBP curriculum?
- Were there differences in self-reported nursing informatics competencies of graduating students

with and without the Palm-based student log and informatics for EBP curriculum?

Class of 2001: Comparison			O	GRAD
Class of 2002: Intervention	O	ADM	X	O
O=observation; X=intervention; ADM=Admission; GRAD=Graduation				

Figure 4. Study Design

Sample

The convenience sample included a volunteer subset of ETP students graduating in 2001 (n=16) and the class of 2002 (n=64).

Study Instrument

The study instrument was based on a published set of 43 informatics competency statements for the beginning nurse that was developed through a literature review and Delphi study of nursing informatics experts. A Likert-type scale was added to each competency statement where 1=not competent and 5=expert. Competence for an item was defined as a score of at least 3. See Table 1 for sample competency statements.

Table 1. Examples of Competency Statements

Computer Skills: Documentation
• Uses an application to document patient care
• Uses an application to plan care for patients to include discharge planning
• Uses an application to enter patient data (e.g., vital signs)
Computer Skills: Decision Support
• Uses decision support systems, expert systems, and aids for clinical decision making or differential diagnosis
Informatics Knowledge: Data
• Recognized the use and/or importance of nursing data for improving practice
Informatics Knowledge: Privacy/Security
• Seeks available resources to help formulate ethical decisions in computing
• Describes patients' rights as they pertain to computerized information management

Procedures

Surveys were administered in a classroom setting during the initial weeks of the ETP program (2002 only) and near graduation. Data were analyzed using SPSS. Mean scores were created for each cluster of competency statements (e.g. Computer Skills: Communication included 4 items). Paired sample t-tests were used to compare informatics competency scores at admission and graduation for the class of 2002. Independent sample t-tests were used for comparisons between the classes of 2001 and 2002 at graduation. Equal variances were not assumed because of the difference in sample size for the 2001 and 2002 graduates. Due to multiple t-tests, the alpha for significance was set at $p < .005$.

RESULTS

Sample

At the time of admission to the ETP program, the majority of the 2002 sample was age 20-29 (76%), female (90%), held a bachelor's degree as highest level of education (80%), had a computer at home (93%), and used a computer at least once per day (81%). Fifty-three percent used some type of hand held computer. Overall, the most frequently used computer applications were: email (100%), Internet (98%), word processing (89%), spreadsheet (43%), presentation package (e.g., power point) (41%), and electronic calendar (39%). The comparison class of 2001 was similar demographically with the exception of age; 41% were older than 29. No data regarding computer use at time of program admission was available for the Class of 2001 consequently no comparisons are possible.

Informatics Competencies

For the class of 2002, scores increased significantly in all competency areas from admission to graduation (Table 2). Using a minimum score of 3 to indicate competence, 2002 ETP students were competent in four areas at admission: Computer Skills: Communication, Computer Skills: Basic Desktop Software, Computer Skills: Systems, and Informatics Knowledge: Impact. The only area in which competence was not achieved at the time of graduation was Computer Skills: Education. For 2001 graduates, Computer Skills: Decision Support was also below 3. Six scores for 2002 and 5 for 2001 were higher than 4; the difference was in Computer Skills: Basic Desktop Software. Using a $p < .005$ for significance, there were no significant differences between 2001 and 2002 graduates. Computer Skills: Decision Support neared significance, $p=.049$.

Table 2. Comparison of Nursing Informatics Competencies

Beginning Nurse Informatics Competency Scale	#Items	2002 ADM n=64	2002 GRAD n=64	2001 GRAD n=16	2002 ADM v. 2002 GRAD	2002 GRAD v. 2001 GRAD
		M (SD)	M (SD)	M (SD)	p	p
Computer Skills: Administration	2	2.40 (1.15)	3.47 (0.89)	3.09 (1.21)	.000	.260
Computer Skills: Communication	4	3.49 (0.81)	4.28 (1.24)	4.03 (0.69)	.000	.295
Computer Skills: Data Access	5	2.53 (1.02)	3.68 (0.92)	3.49 (0.82)	.000	.477
Computer Skills: Decision Support	1	1.27 (0.68)	3.37 (1.23)	2.63 (1.31)	.000	.049
Computer Skills: Documentation	3	1.40 (0.85)	3.57 (1.01)	3.08 (1.08)	.000	.115
Computer Skills: Education	2	1.39 (0.82)	2.67 (1.28)	2.72 (1.39)	.000	.936
Computer Skills: Monitoring	1	1.37 (0.85)	3.63 (1.17)	3.50 (1.46)	.000	.735
Computer Skills: Basic Desktop Software	5	3.13 (1.06)	4.13 (0.88)	3.92 (0.86)	.000	.383
Computer Skills: Systems	8	3.26 (0.86)	4.32 (0.80)	4.03 (0.83)	.000	.230
Informatics Knowledge: Data	1	2.50 (1.53)	4.13 (1.06)	4.06 (0.92)	.000	.812
Informatics Knowledge: Impact	8	3.17 (1.01)	4.31 (0.83)	4.30 (0.74)	.000	.939
Informatics Knowledge: Privacy/Security	2	1.86 (1.07)	3.98 (1.15)	3.72 (1.26)	.000	.825
Informatics Knowledge: Systems	1	2.36 (1.42)	4.09 (1.15)	4.00 (1.21)	.000	.815

DISCUSSION

The study results indicate that students' ratings of their informatics competencies increased over the course of the Phase I ETP curriculum for the class of 2002 and that in all but one area, Computer Skills: Education, competence (i.e., score of 3) was achieved. Some of the competencies measured were specifically health-related and were closely associated with the Palm-based clinical log and/or the informatics for EBP course (e.g., Computer Skills: Documentation, Computer Skills: Decision Support, Informatics Knowledge: Privacy Security). Computer Skills: Education consisted of items related to use of computer-assisted instruction and use of

information technologies for patient education. There are several potential reasons for not achieving competence in this area. First, computer-assisted instruction was not a topic in the informatics for EBP class. Second, students critically evaluated patient education sites on the Internet as a class assignment, but may have had minimal opportunities for using information technologies for actual patient education.

The types of Computer Skill competencies that the students rated as greater than 3 on admission were generic in nature and reflective of basic computer literacy. This was also true of 6 of the 8 items in Informatics Knowledge: Impact. These findings are consistent with the age of the study sample.

The lack of significant differences between the 2001 and 2002 graduates is not surprising for several reasons. First, 2001 ETP students did receive some informatics content as part of their management and informatics class. Second, the 2001 ETP sample was small and did not include all students. Those that agreed to complete the informatics competency survey may not have been representative of all students in the class. In addition, given a sample of only 16, there was inadequate power to detect anything less than a large difference between the two groups.

The favorable results of this evaluation supported continuation of the general approach with revision in certain areas. The student clinical log and the informatics for EBP curriculum have been refined for the class of 2003 in several ways. The ETP student clinical log has undergone additional iterations to improve its usability. Additionally, instead of a single 3-unit course, the informatics for EBP curriculum now consists of three, 1 – unit courses focused on case management, decision support, and patient education taught in smaller sections.

Concurrently, a student clinical log for the advanced practice nurse program has been designed and implemented so that students can continue Palm-based documentation of their patient encounters as they progress through the Master's program in their advanced practice nurse specialty area.

Informatics competence is a prerequisite for healthcare professionals to optimally use information technology to promote patient safety and to enable evidence-based practice. Innovative educational approaches such as the one described in this paper demonstrate promise as a method to achieve this competence

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